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Figure 1. A seine net being used for the capture of carp from a pond at the Damien fish farm near Port-au-Prince, Haiti. (See pp. 230-33).



Figure 2. Trainees of a fish culture training course in Thailand practising pond construction. (See pp. 223-30).

DISEASE AS A FACTOR IN NATURAL MORTALITY OF MARINE FISH^{1,2}

Although there is an active and effective interest in the diseases of fresh-water fish, and a correspondingly useful body of literature in this field, there is much less interest, and a much sparser literature on the diseases of marine fish. The interest in the diseases of fresh-water fish grew out of practical and economic necessity: in Europe, and more recently in North America, the losses caused by disease have proved troublesome and expensive and it was natural that investigators should turn their attention to a study of these diseases and to a search for means of controlling them.

The first studies of fish diseases were made on infected fish in the restricted natural habitats of ponds and streams where, from time to time, epidemics have occurred, destroying stock almost entirely (Babes and Riegler, 1903). As the practice of fish culture increased there developed techniques for the control of disease. It may be said that fish culturists now are familiar with a range of fish diseases, and have available a useful battery of drugs and techniques with which to combat and control them. But it must be stressed that this situation prevails only for cultivated stock within restricted environments, and that it relates to a few species of fish whose condition, in health and disease, is familiar to the culturist who, moreover, has the stock under constant observation. As a consequence, the literature on fish diseases relates almost exclusively to those of fresh-water fish. The classic works on the subject are those of Plehn (1924) and Schäperclaus (1941) which summarize the literature up to 1940.

The natural environment of a lake, pond or stream, usually provides optimal conditions for the growth and multiplication of micro-organisms. Consequently it is not uncommon to find there rather large bacterial populations. While many people recognize this, very few know that the same holds true for a marine environment, and that the presence of salts is not a limiting factor. Salt water has been proved to be a natural habitat for bacteria and other microbes which may cause diseases in fishes.

Parasitism of fish has received much attention as is shown by the number of papers concerning copepod, helminth and other parasites to be found listed by the abstracting and bibliographic services. For the purposes of this paper, however, we are not considering this aspect of mortality but that which is understood by the term pathology; and in this field relatively few articles on micro-organism caused diseases of marine fish appear in the literature (Moore 1912; Aronson, 1926; Bruun and Heiberg, 1932; ZoBell and Welles, 1943; Schäperclaus, 1941; Nigrelli and Hunter, 1945; Rucker, 1949; Hodgkiss

¹ By Carl Oppenheimer, Marine Microbiologist, University of California, Scripps Institution of Oceanography, La Jolla, California, U.S.A., and G.L. Kesteven, Marine Fisheries Biologist, FAO, Rome, Italy.

² Contribution from the Scripps Institution of Oceanography, University of California, New Series No. 656.

and Shewan, 1950). Fungus infections in marine fishes have been occasionally reported (Fish, 1934 ; Sproston, 1947) .

Although approximately 70 percent of the earth's surface is covered by the oceans, relatively few scientists are engaged in studying the sea, and of these very few indeed are marine microbiologists. Interest has lagged because of the obviously limited practical application of such research and because there are few organizations where the necessary specialized training is offered. But the paucity of attention given to the diseases of marine fish may perhaps be best ascribed to two considerations ; firstly, that the resources of the sea have seemed inexhaustible, and secondly, that even if disease-causing organisms might prove to be an important factor in these environments, of which few people were convinced, it seemed even less likely that anything could be done about them. But now that we begin to recognize some of the limitations to these resources, and as we look deeper into the intricacies of the ecosystems of which our commercial species form part, we begin to suspect that perhaps these diseases are more significant than we had thought, and that they merit closer attention.

Many people have doubted the presence of widespread marine fish diseases. This is quite easy to understand because, for two general reasons, such diseases may easily pass unnoticed. The first is concerned with the physical properties of water. The change in refractive index between water and air causes the visual properties of objects to be changed, and, in consequence, infectious growths which may be recognized on a fish when it is in water, may become inconspicuous or invisible when it is removed into the air. To this is added the complication that lesions on fish are not easily observed in their natural habitat because it is quite difficult to get within observation distance.

During the summer of 1952 at the Scripps Institution of Oceanography, Conrad Limbaugh made an investigation of certain fish in their natural habitats. Using a diving unit which allowed him freedom in the water for periods up to 45 minutes and at depths to 100 feet, he estimated that from 5 to 10 percent of fish of several types had lesions involving the scales, tail and fins. Several of the infected fish were speared and brought to the surface for bacterial examination. In the air the fish appeared normal and the diver had to point out the places where he had seen the infections. Later examination of the lesions by phase microscopy and by cultural methods revealed that large numbers of bacteria were present. These observations demonstrated that an observer cannot easily see the infected part of the fish when it is out of water and, therefore, lesions may be overlooked in routine observations in the laboratory and even in the field. Similar infected fish were prevalent during the summer of 1953.

The second reason which might explain why fish diseases have passed unnoticed is that natural predation would tend to remove infected fish from observation. An infected fish is usually less active and

soon falls prey to its natural enemies. If this were a substantial effect, constituting a high rate of natural mortality for such fish, relatively few of them would be caught, and this would suggest that they are scarce in nature. Mr. Limbaugh noted that most fish with lesions took cover sooner than their healthy neighbors, as though they sensed their incapacity.

Careful observations of fish from three marine aquaria along the coast of southern California have demonstrated that infections are common, especially when the water temperature increases during the warm summer months. The lesions of such infected fish are not detected by ordinary observation, but only by the most careful examination.

Several types of external lesion have been noted in marine fishes in salt-water aquaria. It is common to find tail-rot or fin-rot, a type of disease which is usually slow but persistent, where the fins and tail erode away. A white cotton-like growth may involve the bases of the scales, which are thus pushed away from the body, making the integument appear rough in places. Necrotic lesions of the integument may be present. Infections in fish eyes cause the lens to become opaque. Occasionally, the formation of gas in the chamber of the eye tends to make the eye appear "popped". Some fish are seen in which the eye lens has fallen out as the result of an infection, and the socket healed shut. External bleeding of the skin, believed to be caused by bacterial infection, has been observed and appears to cause the death of the fish. Other fish have been observed to lose their equilibrium and to swim in various abnormal positions.

At times fish lesions caused by *Pseudomonas ichthyodermis* have reached almost epidemic proportions. During the summer months of 1952 and 1953, it has been possible to isolate this organism from the ocean near shore and from the marine aquarium at the Scripps Institution. At the same time, a high percentage of the fish in the aquarium had characteristic lesions although apparently only certain species of fish were sensitive to the bacteria. It has been found that this organism is inhibited by penicillin.

As a result of diseases and the lack of knowledge for their control, many valuable fish are lost in marine aquaria each year. During the summer of 1952, one aquarium on the west coast of California lost a large part of the fish stock because of disease. Many valuable fish could have been saved if the aquarium keepers had known how to recognize and combat the infections.

It is likely that certain diseases are carried into aquaria by newly caught fish, especially those which have been injured during capture. The practice of isolating or quarantining new fish for suitable periods of time is of great importance to the maintenance of a healthy aquarium. Information regarding the length of isolation, and prophylactic treatments of marine fish, is very scanty and offers interesting problems for properly trained microbiologists. In any event it is obvious that whatever the deficiencies of aquaria as a means of investi-

gating other aspects of fish biology, they offer admirable opportunity of studying diseases.

Thus, while the foregoing evidence suggests that the reason for the neglect of this field of study most probably is that various factors have operated to conceal the effects of disease-causing organisms on mature fish, there is useful evidence concerning disease effects in young stages.

Ahlstrom (1948) has reported abnormalities in up to 45 percent of sardine eggs collected during a study of the Pacific coast sardine. It is possible that marine bacteria may have been responsible for a proportion of the abnormalities.

It is significant that about 65 percent of the known species of marine bacteria attack protein. Recent experiments by one of us (C. H. O.) indicate that bacteria may have adverse effects on the eggs of sardine, flatfish and codfish. The hatching rate of these eggs in the laboratory is increased considerably when the eggs are cultivated in a bacteria-free medium. Direct microscopic examination, by phase microscopy, of marine fish eggs collected from their natural habitat revealed the presence of large numbers of bacteria and other micro-organisms attached to the egg shell surfaces.

In view of the recently obtained evidence of the prevalence of diseases among marine fish, and drawing upon our knowledge of the importance of diseases among fresh-water fish, we may speculate upon the significance of such diseases among marine fish.

It is reasonable to say that up to the present there has been found no comprehensive analysis of the term "natural mortality" in the population equations which have been prepared for natural stocks. The term has, in fact, been chiefly an item introduced by deduction into an arithmetic operation. Much attention has been paid to the measurement of the amount of mortality, but little work has been done on its causes, and that which has been done has related chiefly to the egg and larval stages. Thus, Dannevig (1940) suggested that certain physical effects of storms might be lethal to eggs; Sette (1943) and others have written of the effects of currents in carrying eggs and larvae into situations unfavorable in respect of salinity, temperature, or food supply; Ricker and Foerster (1948) have discussed the nature of mortality among the juvenile stages of sockeye and have suggested that under-nourishment might be a potent factor; Herrington (1948) also discussed types of mortality but seemed to place more emphasis on starvation mortality than was acceptable to some workers (e. g. Kesteven, 1950). The possibility of non-predator types of mortality has been recognized, but neither the nature nor intensity of these has been systematically treated.

There is also the case of the severe mortality which broke out among commercial species of sponge in the Bahamas late in 1938 (Galtsoff *et al.*, 1939). This mortality appeared to be caused by a fungoid micro-organism, and similar mortalities were reported later off Tarpon Springs, Florida, the southern coast of Cuba, and the coast of British Honduras (Smith, 1939). One species of sponge in

the Bahamas, called the "Velvet" sponge, was so severely affected that to the knowledge of one of the team which investigated the 1938 mortality (H.H.Brown), no living specimen has been found in the waters of the Bahamas since 1939. It is possible, therefore, that this is an example of the complete extinction of a species; Professor C.M. Yonge commented in this sense in an article in *Nature*.

A classification of causes of mortality in natural fish population would propose six principal categories of directly operating factors, namely:

- | | |
|-----------------|----------------------------------|
| 1. predators | 5. food deficiency |
| 2. parasites | 6. physical and chemical factors |
| 3. pathogens | at lethal values, which at |
| 4. lethal genes | times are of biotic origin. |

In addition, any one of these could alone, or in combination with others, render the fish vulnerable to other factors, and, in particular, the intensity of predation might be increased by one or more of the other factors. Of possibly even greater significance is the relation of intensity (of the effect of these factors) with population density, and the speed with which a change in density is followed by a corresponding change in intensity of mortality effect. Since each upswing of population carries a potential for still greater increases, the controlling factors must contain a similar potential for geometric increase of their force. This conclusion is derived from the evidence that natural populations generally maintain a kind of balance whilst at the same time oscillating about the balance level; but the evidence on the amplitude, speed and rhythm of oscillations in some populations suggests, on the one hand, that there must be intricate interactions between the controlling factors, and, on the other, that their sum effect must be closely density dependent. Of the categories above we have doubts about food deficiency as a direct factor although doubtless it could be a predisposing one; physical and chemical factors would seem, except in special circumstances, to be independent of population density; we know nothing of lethal genes in natural fish populations, and we think that predators could not respond sufficiently quickly; for these reasons we are disposed to believe that the principal control responsibility must rest with parasites and pathogens, and most with the latter in view of their more rapid reproduction and presumably easier dispersion.

The value of the foregoing argument would be somewhat lessened if it should be shown that success of spawning and survival of eggs and larvae, and thence brood strength, were entirely fortuitously determined by density independent factors, and that once the brood strength was determined it gradually receded down the mortality curve at a rate "normal" for the population as a whole. However, we do not know of any evidence, among the data on fish population fluctuations, of a freedom and amplitude of oscillation such as would inevitably manifest itself if this were the mechanism. In contrast, there

is steadily accumulating evidence of epidemic mortalities of massive proportions (e. g. Gunter, Smith and Williams, 1947). For some of these it has been established with a fair degree of certainty that they were caused by toxic effects of "red water" (Galtsoff, 1949; Smith, 1947; Allen, 1946) and similar phenomena; but in other cases where the cause remains undisclosed (Oppenheimer, 1953), it seems reasonable to believe that it might have been disease.

The recent work on diseases among marine fish will be seen to have, against this background, a very great potential significance. At the present stage of fisheries biology the main task is to develop an accurate description of the natural systems from which we draw our commercial catches. And in these systems the force of natural mortality is of great importance. If the study of these diseases could contribute to an analysis of the incidence and the intensity of natural mortality it would greatly help the fisheries biologist in describing the dynamics of these systems and in evolving systems for prediction of their behavior. It is unnecessary, at this stage, to speculate upon the contribution which might make for the control of such diseases in some later stage when man's intervention in such natural systems might become more effective than it is at present.

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INLAND FISHERIES PROJECT IN THAILAND¹

Fish culture in Thailand is a rather recent development. It is true that for a great many years people of Thailand released fish into the ponds and sanctuaries of the temples all over the kingdom, but such practices were mainly for religious purposes. The actual practice of fish culture in ponds for food, as it is generally agreed, was started about 40 years ago by some Chinese immigrants who brought with them some common carp (*Cyprinus carpio*) from China. Soon afterwards, fry and fingerlings of other major Chinese carps were imported every year for culture. Such culture operations, however, were done only on a small scale by a few Chinese, and were confined to the Bangkok area.

A program for the development of fish culture was initiated by the Thai Fisheries Department some 20 years ago. Since then, four inland fisheries experimental stations have been established, each of which is provided with a few buildings, some ponds and hatchery facilities. In September 1951, FAO, under its Expanded Technical Assistance Program, initiated a project, in collaboration with the Thai Government, aimed at increasing production from Thailand's inland fisheries through the development and promotion of fish culture.²

Encouraging results have been obtained since the initiation of this project. Each of the four fisheries stations is being equipped with the basic hatchery and transport facilities, and is at present able to produce fish seed for distribution and to render services in the promotion of fish culture in their respective regions.

Some simple but practical methods for the culture of fish have been developed by adopting the various good points of the well-known practices existing in China, Indonesia and in other countries where fish is cultured. These methods, along with the introduction of an exotic fish, *Tilapia*, fit well into the socio-economic conditions prevailing in the country. They are readily accepted and, spreading rapidly, have become the principal reason for the great interest in fish culture developed among the people and the government authorities. Over 10,000 private ponds have been converted or constructed for the culture of fish.

The King, the Premier and Deputy Premier have taken keen, personal interest in this matter; all have fish ponds established in their residences and have been distributing stocking material from them free of charge to the people. A special budget of 2 million baht per year for ten years has been appropriated by the Government for the promotion of fish culture; a similar special budget for the development of swamps and tanks is already under consideration.

¹ By S.W. Ling, FAO/ETAP fish culturist in charge of the project.

² See also *FAO Fisheries Bulletin*, IV (3), 40; IV (4), 37; IV (5), 42; IV (6) 24; (1), 30; V (2), 58-60; VI (1/2), 46; VI (3), 95; VI (4), 145.



Figure 3. A typical fish pond in Thailand.

- | | |
|------------------|--------------------|
| A - Ipomoea bush | D - Vegetable beds |
| B - Compost pile | E - Chicken coop |
| C - Pig stalls | F - Feeding ring |

Aside from ponds, over 24,700 acres of swamps, tanks and public waters have also been stocked with fish. The monthly production of stocking material for distribution has increased from about 1,000 fry at the beginning of the project to about 600,000 at present. Two fish culture training courses for Thai fisheries officers have been conducted for a total of 37 trainees.³ Four Thai fisheries officers were awarded Expanded Technical Assistance Program fellowships to study at the FAO-sponsored Indonesian Fish Culture Seminar.⁴ The officers thus trained are actively engaged in various phases of the fish culture development project.

Development of the Existing Fisheries Stations

The technical activities of the fisheries stations have been reorganized, in the main, for investigations and experiments on the improvement of fish culture techniques, the search for natural spawning grounds, the finding of new local fish suitable for culture, etc.

All existing ponds and facilities have been put into active service. A basic set of laboratory equipment for training and demonstration has been supplied by FAO. Laboratory, hatchery, field and transport facilities and basic literature have also been supplied by the United

³ See *FAO Fisheries Bulletin*, VI (5), 207.

⁴ *Ibid.* IV (3), 32; V (1), 26-27; V (2), 63-64; V (3), 157; V (5), 201-204.

States Foreign Operations Administration (FOA), formerly the Mutual Security Administration (MSA).

Trained and competent officers head the stations. Technical staffs have attended organized training courses in Bangkok and in some cases have been given practical "on the job" training at their respective stations.

Establishment of Field Stations

In order to afford an effective extension service to the whole kingdom, five additional field stations have been planned to supplement the activities of the existing fisheries stations. The first of these was established at Maecho in the autumn of 1952. Since April 1953, this station has been rendering active extension services, including the production of stocking material for distribution. The other four are expected to be established soon.

Introduction of Fish Culture Techniques

Well-known techniques have been adapted to local conditions and those that are simple but effective and easy to use are being popularized. *Tilapia*, because it is extremely easy to cultivate in Thai waters, is given to all beginners; other more delicate species are given to those with some experience. The utilization of local derris roots for killing predators; of manure of farm and domestic animals for fertilizing pond waters; of lime and burned rice husk for improvement of the quality of pond waters and of rice bran, residues from oil refining, kitchen wastes, etc., for supplementary food have been very successful. Fish ponds with compost piles at the corners, Ipomoea bush along the edge, and pig stalls and chicken coops on the banks have been found to be very productive and economical, and are especially suitable for farms. The excrement from the pigs and chickens is washed down into the pond every morning to provide, along with the compost piles, a constant supply of fertilizer to the pond water for the production of fish food. Ipomoea is a fast-growing aquatic plant, is a good food for fish, pigs and chickens, and is also a popular table green among the local people. The application of animal manure and rice bran to the pond bottom has resulted in increased production of plankton and the promotion of the growth of blue-green algae covering the bottom. These are both essential for many of the pond fish.

Common carps are being induced to spawn in small breeding ponds at the Bangkok Fisheries Station throughout the year. Local palm fibers (Nepa) have been successfully used as material for the attachment of common carp eggs during spawning. Simple methods of inducing spawning of pla salid (*Trichogaster pectoralis*) and kissing gourami (*Helostoma temminckii*), in large numbers in wooden breeding



Figure 4. Distribution of stocking material at the Bangkhen Fisheries Station.

tanks have also been developed. Propagation of giant goramy (*Osphronemus goramy*) has also been successful. In the culture of Chinese carp, the popular Chinese method, including the number and ratio for mixed stocking, has been adopted with excellent results. By applying the same principle, experiments on mixed culture of local fish have been initiated recently. The culture of Chanos (milkfish) is now being conducted on a small scale at the experimental brackish water ponds in Prachueb Province. With occurrence of large numbers of fry along both coasts of the Gulf of Siam from April to September, there is great possibility for future development of Chanos culture.

Extension Service

All possible means have been taken to create interest in fish culture and to render technical services to those interested. *Tilapia* itself, because of its ability to grow fast and to propagate in almost any environment, has actually become instrumental to the rapid development of the project.

Radio talks, public lectures, and newspaper articles have been given frequently by fisheries officers and prominent authorities.

The keen interest of King Phumipol Aduldet in this matter has been an inspiration to everyone in the kingdom, and is invaluable for the quick promotion of fish culture.

Exhibitions on fish culture during the various temple fairs have attracted the attention and interest of thousands of people. During such exhibition fish fry and extension pamphlets are given to those who are interested. Similar exhibitions have been conducted during the annual science conference, the National Day Fair, the Constitution Fair and other national and public functions.



Figure 5. Ditches in a vegetable garden in Thailand used for fish culture.

Demonstration fish ponds have been established at the various fisheries stations, at the residences of senior government officials, and near provincial and district offices. Service centers have been established in co-operation with the local district civil officers in important districts. At the inauguration of the centers, plenty of stocking material was distributed free of charge. At the beginning these centers serve only in the distribution of material provided by the Fisheries Department ; gradually they begin to produce stocking material from their own ponds for distribution. This has proved to be very effective and is expected to be extended eventually throughout the country.

Extension services have also reached some armed forces barracks and prisons. Besides making use of idle waters for producing more food, fish culture serves also to train soldiers and prisoners in a useful occupation.

Traditional religious observances in releasing fish as "living offerings" in temple and private ponds have also been directed to practical fish culture purposes without sacrificing their original beauty. *Tilapia* fingerlings have been used to substitute for the customary pla mor (Anabas). In the District of Pra Pra Daeng alone, about 20,000 *Tilapia* fingerlings were stocked in suitable ponds as "living offerings" during the annual Songkran Festival. Since then this district has enthusiastically taken up the culture of *Tilapia*.

An extension pamphlet in Thai on "How to Culture *Tilapia*", prepared and published jointly by the Thai Ministry of Agriculture, FAO and the United States FOA, became so popular that more than 150,000 copies have already been distributed and 110,000 copies of a revised edition will soon be ready for distribution. Revision of fisheries extension pamphlets on "Common Carp Culturing", "Pla Salid Culturing", "Culturing of Giant Gouramy" and "Culturing of Pangasius Cat-fish" is in progress.

Field service teams have been organized for rendering practical technical aid, such as pond construction, removal of weeds, killing of predators, application of fertilizers, stocking of fish, etc. To meet the ever-increasing demand for stocking material all available hatchery facilities and ponds of the fisheries stations have been fully utilized. In addition, many new breeding and nursery ponds have been constructed. The total amount of stocking material produced and distributed monthly has increased from about 1,000 fry at the beginning of the project to about 600,000 at present.

Over 10,000 village and farm chiefs are to be trained in one to two years on practical fish culture under a program already initiated. Training is to be conducted at the fisheries stations for surrounding districts for about 50 trainees at a time; for distant districts competent fisheries officers are to be sent to do the task.

Promotion of Fish Culture in Tanks, Swamps and Rice Fields

Work on this phase of fish culture development is only beginning. Of over 2,500,000 acres, only about 10,000 acres of tanks, 15,000 acres of swamps and 125 acres of rice fields have been stocked with fish. Good results have already been obtained for swamps not over 25 acres. Pla salid adapted themselves very well in practically all the tanks and swamps stocked, while *Tilapia*, so far, has not been observed to establish itself in any of the natural waters where there are large numbers of predators present. Local plant-eating carp have been found to be of great value for assisting control of submerged vegetation when stocked in tanks and swamps.

Tilapia and rice grow very well together in paddy fields. However, there are still many problems concerning the control of the water

level, predators and enemies, etc. to be solved. A program for the development of swamps, tanks, and paddy fields of the north-east area for fish production is now under preparation by the Fisheries Department. This program is expected to be initiated before the end of this year with the co-operation of the United States FOA and with technical assistance from FAO.

Training of Fisheries Officers and Technicians

The training of local personnel has been regarded by all concerned as an essential part of the present Expanded Technical Assistance Program.

1. "On the Job" Training

This type of training has been rendered to all officers of the various fisheries stations during the visits of the FAO fish culturist and to the extension officers of the Fisheries Department, at every opportunity. The training includes practical problems in fish culture operations, the planning and carrying out of fisheries field surveys, planning and conducting extension services, etc.

2. Fish Culture Training Courses

Two sessions of the 6½ weeks vocational training in general fish culture have been conducted at the Bangkhen Fisheries Station. The first session was held during September-October 1952 with 12 trainees and two observers; the second session during May-July 1953, with 25 trainees and one observer. Trainees were selected from among the technicians of the fisheries stations, fisheries officers working in the provinces and districts and teachers of agricultural vocational schools. Two fisheries officers from Viet-Nam and one fisheries officer from Burma attended the training course as full trainees. Instruction included: general biology of common pond fish; principles of limnology in relation to fish culture; studies on the physical, chemical and biological conditions of pond and natural waters; practical work on fisheries field survey; principles and practices in the various aspects of fish culture (construction and management of ponds, fertilizing pond waters, elimination of predators, eradication of weeds, breeding of fish, rearing of fry and fingerlings, culturing of big fish, transportation of fish seed, etc.); and principles and practice in conducting extension services.

3. Fellowships

As part of the present ETAP project six fellowships have been made available for qualified Thai fisheries officers. Four officers were awarded fellowships for training at the FAO-sponsored

Indonesian Fish Culture Seminar ; one during the first session, and three during the second. Each of the four officers is now in charge of a fisheries station.

Comments

It is to be noted here that though this project has made a good start, it is still far from its ultimate goal. The foundation is still young and weak, especially in scientific aspects. Large numbers of technicians are yet to be trained to take care of the rapidly expanding activities. Many difficult problems concerning fish culture in tanks, swamps and paddy fields remain to be solved. More efficient techniques are still to be experimented with, developed, tested and put into practical application. Time and patience are essential, and co-operation and support from all concerned are indispensable to the future success of this project.

FISH CULTURE PROJECTS IN HAITI AND THE DOMINICAN REPUBLIC¹

Haiti

In 1948, the United Nations sent a Technical Assistance Mission to Haiti to ascertain the steps which might be taken to develop the natural resources and to improve the socio-economic conditions of the country. Following the recommendations of that mission,² the United Nations and its Specialized Agencies initiated a program in 1950 aimed at the economic development of the country. Included in the Mission was an FAO fisheries expert, Dr. E. F. Thompson, of Yale University, New Haven, Connecticut, U.S.A., who recommended that fish culture in ponds, lagoons and rice fields might become an integral element of rural welfare in Haiti.

Haiti possesses a number of lakes, rivers, reservoirs, swamps and lagoons rich in fish food. These waters were producing at an extremely low level. The reasons were: the fresh-water fish fauna was poor, none of the indigenous species yielded sufficiently to be of economic importance to the country; fish farming and related fish culture methods were unknown in Haiti, while fishing in inland waters was restricted to part-time activities.

In June 1950, FAO sent S.Y. Lin, a fish culture specialist, to survey the inland waters of the country and as a result he drafted a five-year plan for inland fisheries development, which was accepted by the Government of Haiti. In order to implement the plan, the Government then requested assistance from FAO under the

¹ By S.Y. Lin, FAO fish culturist.

² See United Nations, Mission to Haiti, Lake Success, New York, 1949.

Expanded Technical Assistance Program. In December 1950, an agreement between FAO and the Haitian Government was signed which made provision for such assistance.

S.Y. Lin was sent to develop the project, which called for utilizing as extensively as possible all the inland waters for fish production. To achieve this, it was necessary to introduce methods and techniques which were easy to learn and to apply and to introduce fishes which were prolific, fast-growing, hardy and vegetarian in feeding habits.

There are three types of waters in which fish can be cultured—artificial ponds, which are recommended for those farmers who have the capital and ability to build them; natural waters, such as rivers, lakes and flooded areas, which in this case must be stocked by the Government or public agencies; and rice fields, which, if used for fish culture, will not only produce fish, but will also increase the rice crop by 7 to 10 percent.

The fish culture development program in Haiti consists principally of:

1. the establishment of a demonstration and propagation center with a sufficient number of ponds for fish breeding and production;
2. introduction of exotic fish for culture;
3. extension of fish culture in ponds and rice fields;
4. rough release of fish into the natural waters;
5. the training of local personnel in fish culture practices.

Pond construction was started in November 1950 and, by February 1951, six small ponds were completed and made ready for stocking fish. Then, 120 carp (*Cyprinus carpio*) yearlings were brought from Alabama, U. S. A., to be grown as breeders for propagation purposes. In July, some 100 *Tilapia mossambica* were introduced from Jamaica, B.W.I. All these fishes acclimatized themselves well in Haitian waters; three months after their introduction, the *Tilapia* were found multiplying by the thousands and the carp spawned in a specially constructed pond in May 1952, only 15 months after their introduction.

Then, with plenty of fish fry on hand, extension activities were begun. Publicity was given in newspapers, periodicals, schools, radio broadcasts, and through special pamphlets, to popularize the idea of fish culture. These activities were supported by demonstrations. When the idea became known, many people were interested in the similarity between raising fish, chickens or cows. Fish culture became very popular and farmers are now continually seeking advice from the officers concerned with the project about the construction of ponds in various parts of the country. As a result, ponds have been built at farms in various communities, such as those in Marin, Croix des Missions, Damien, Carrefour, Mejer, Artibonite Valley, and Marbial. While much remains to be done in establishing fish farms at suitable

places over the country and while fish farmers still have to be trained to take good care of them, the interest of the general public has been aroused in fish culture.

Cooking demonstrations were held for carp and *Tilapia* and the cooked fish tasted by many people. The results were extremely encouraging: the news spread throughout the country that carp and *Tilapia* made delicious dishes. This publicity paved the way for the ready marketing in 1952 of the fish produced in the experimental



Figure 6. A rearing pond under construction at the Damien fish farm.
(Courtesy Arthur O'Neill, Port-au-Prince, Haiti).

ponds and of some 6,000 lb. in 1953. The demand was so great that whenever fish were brought to market they were sold immediately, none being left for the late comers, who were greatly disappointed.

The rough release of *Tilapia* into the Estere River was started in late 1951 and, by the autumn of 1952, good results were already observed when the villagers living around the river caught some big *Tilapia* and dried them for food. Several thousands of *Tilapia* and carp fingerlings were released into the Estere and Artibonite rivers, Lake Saumatre, and other waters in 1952: the release is being continued in 1953 and will be for some years to come. Recently, when

visiting the Artibonite Valley, the FAO fish culturist found that about 4 percent of the catch from rivers and canals in the region was *Tilapia*. This marked the first time that a good yield of *Tilapia* has been obtained from open waters in the Caribbean area. It is hoped that within three or four years, the growth and multiplication of carp and *Tilapia* will be extensive enough to support an inland fishery of considerable importance.

Because of the shortage of personnel and facilities, the practice of fish culture in rice fields has not yet been tried in Haiti, but there seems to be nothing to hamper such development in the future.

In November 1952, Shimon Tal, a fish nursery expert from Israel, was assigned to assist S. Y. Lin in Haiti and is carrying on the project while Mr. Lin is on another assignment. As the FAO experts will leave the country as soon as their mission is completed, it is especially important that the assistants provided by Haiti to help these experts be trained to continue the program, as well as to make plans for further development.

Arrangements have been made to enable the local staff to learn as much as possible from the experts during the course of the project. In addition, fellowships were provided for two of the assistants to study abroad. The first was given to Leonce Bonnefil Jr., a senior officer in the Department of Agriculture, to study fish culture in Indonesia from September to December 1951, and the second to Emmanuel Garnier, an officer of the same department, to study for three months in 1952 in Brazil and Surinam. It is hoped that, in the future, more work can be accomplished in the field of extension services.

Dominican Republic

Despite the fact that the Dominican Republic raises a considerable amount of fruit, vegetables, rice and cattle, the production of protein food is still insufficient to supply the population. For this reason the country has to import a great deal of food, including several thousand tons of fresh, dried and salted fish. Being aware of this situation, the Government asked FAO for technical assistance to explore the possibility of fish culture with a view to producing more protein food.

In response to this request, FAO assigned S. Y. Lin to the country, to initiate an inland fisheries program. Shortly after his arrival in April 1953 he completed a short survey of the conditions existing in the country and prepared a plan for the development of fish culture. The Government approved his plan, which aims at applying in the Dominican Republic fish culture practices successfully developed in other countries and the experience gained in recent years in the Caribbean area.

It is visualized that within three years demonstration activities will be sufficient to show clearly to the people that fish culture is an effective means of producing food and there will be some fish farms established in the country.

The steps to be taken are essentially the same as those being taken in Haiti.

A site covering about 25 acres of land in Hacienda María, near San Cristobal, was selected for the building of the first propagation and demonstration center. The construction of ponds began on 8 May 1953 and by the middle of August 13 ponds, with a total water area of $8\frac{1}{2}$ acres, were completed and ready for use. Four large ponds from 7,800 to 9,600 sq. yds. in size are being used for carp production experiments while smaller ones, each 960 to 1,200 sq. yds., are reserved for use as propagation and nursery ponds. It is hoped that three more ponds covering a total area of 10 acres will be built for carp production before the end of the current year.

The construction of the ponds was carried out under the combined efforts of the Department of Agriculture and Public Works. The result is very satisfactory; in the short period of three months very much has been accomplished. The large ponds are now stocked with some 3,600 carp fingerlings and *Tilapia*; within a few months there should be some fish for breeding and trial marketing. If the projects continue so satisfactorily, another demonstration center will be built in Jima, one of the important rice producing districts of the country, at the beginning of 1954, in accordance with the plan.

Conferences and Meetings

British Association for the Advancement of Science

The 115th Annual Meeting of the Association, held in Liverpool, England, 1-9 September 1953, was of special interest to fisheries workers since Section 'D' devoted much of its time to papers dealing with fisheries subjects and related fields. In addition, the business sessions were preceded by a two-day symposium on the deep-sea floor and the history of the earth, arranged by the International Joint Commission on Oceanography.

The presidential address of Section 'D', given by Professor H.E. Smith, of Queen Mary College, London, dealt with the maintenance and spread of sea-shore fauna and reported a survey of the circumstances affecting the numbers and distribution of shore animals with special reference to the British inter-tidal fauna. This address was followed by a session devoted to shellfish biology, in which papers were read on sex change in the pink shrimp *Pandalus montagui*; the growth and breeding of the scallop *Pecten maximus*; environmental factors governing oyster production in Essex; and *Mytilicola intestinalis*, a destructive parasite of mussels. This session further included two films, one on how Conway mussels are fished and purified, the other on experimental oyster culture.

A session was devoted to how animals find their way about, and included a paper on direction finding in fish, and landward and seaward movements of the sandhopper *Talitrus saltator*.

At a session on new advances in underwater observation papers were given on "Photography of the Sea Floor"; "The Taking of Underwater Films by Frogmen"; "Echo Sounding in Marine Biology"; "Underwater Television in Marine Biological Research"; and "Seismic Measurements in the Pacific". These papers were illustrated by some most striking photography.

A joint meeting of Sections 'C' and 'E', Geology and Geography, discussed the Continental Shelf. This session consisted of three papers of which the first dealt with the Celtic Sea and the eastern North Atlantic — their hydrography in relation to marine biology and submarine geology; the second with the hydrography and natural history of the Bear Island Shelf; and the third with the territorial problems associated with the Continental Shelf.

Inter-American Tropical Tuna Commission

The fifth meeting of the Commission was opened in La Jolla, California, U.S.A., on 14 August 1953. José L. Cardona Cooper, of Costa Rica, presided. The research program of the Commission for

next year, administrative questions and international problems were considered and the report for 1952 was adopted. Several sessions were devoted to a discussion of the research carried out by the Commission during the past year and of the results obtained in the fields of biology, ecology, oceanography, and dynamics of tuna stocks and bait fish.

In accordance with a resolution of the Commission, work was to begin in September 1953 on the restocking of Nicoya Gulf, formerly a rich Costa Rican ground for live bait, with anchoveta. The Panamanian Government has granted permission for the fish to be taken from its waters according to an arrangement made last October.

Lee F. Payne, of the United States, was chosen as the next President of the Commission.

International Council for the Exploration of the Sea (ICES)

The Council's 41st meeting took place at Charlottenlund Slot, Copenhagen, Denmark, from 28 September to 6 October 1953, under the presidency of A.T.A. Dobson, of the United Kingdom, and with some 130 participants — delegates, experts, observers and guests. As the President noted, the meeting was unique in the representation from countries not members of the Council (there were representatives from Australia, Canada, Greece, the Argentine and the U.S.A.) and in the fact that no less than four international organizations were represented at this meeting by their present, or late, chairman — the International Commission for the Northwest Atlantic Fisheries, the International Whaling Commission, the Permanent International Council for the Scientific Exploration of the Mediterranean Sea, and the Permanent Commission of the 1946 Fishery Convention. FAO and the Indo-Pacific Fisheries Council also sent observers.

A large proportion of the time of the meeting was devoted to the work of the area and subject committees, and to two special scientific meetings. More than 50 papers were submitted at these meetings, apart from the statements made at different meetings on behalf of member countries of the work being carried out in various fields. Films shown during the meeting included one on the life history of the eel (intended primarily for educational purposes), and one on some new equipment for tagging herrings. New equipment for work in hydrography, planktology and biology was demonstrated. For the most part the work of the committees was devoted to receiving accounts of investigations in progress and reviewing the situation of the fish stocks in each of the Council's sub-areas; on the basis of this work recommendations were made for future programs. However, special attention was paid to conservational problems by certain committees.

In respect of Baltic salmon, it was decided to recommend that the Council take steps to submit the following proposals on conservation of the stocks of salmon in the Baltic to the Royal Danish

Government for consideration and transmission to the Governments of Sweden, Finland and Germany :

1. prohibition of the use of drift-lines in the months of December-March ;
2. establishment of a minimum size for salmon landed of at least 50 cm., but preferably 55 cm. ;
3. establishment of a minimum size for the mesh of salmon drift-nets so that when the mesh is stretched diagonally lengthwise of the net a flat gauge 160 mm. broad and 2 mm. thick could pass through it easily when the net is wet;
4. establishment of a minimum size of 19 mm. for the gap (least distance between point and shank) of the hooks of the drifting and anchored lines used in the salmon fishery.

In addition, in answer to a request for advice received from the President of the Permanent Commission of the 1946 Fishery Convention it was decided to set up a liaison committee consisting of the Chairman of the Consultative Committee as chairman, together with the chairmen of the North-eastern, North-western, North Sea and Atlantic Committees, with power to co-opt other members.

The Special Scientific Meeting on Cod accomplished an extensive review of current work and results on this species, contained in 13 papers. These papers will be published in a special number of the *Rapports et procès-verbaux des réunions*. The Meeting recorded its views as follows :

- (a) experiments on cod, in which the effects on growth and related physiological characters of controlled variation in temperature and food should be arranged ;
- (b) morphological observations on different populations of cod should be carefully recorded for comparison with experimental work ; and
- (c) the Special Scientific Meeting on the Sampling of Fish Populations, proposed by the North Sea Sub-Committee, should be given every support. Its terms of reference should be understood to include an evaluation, not only of methods of collecting and sampling at present in use, but also the methods used for dealing with these samples, and suggestions for the future designed to provide standard information on growth, mortality and recruitment, so as to furnish adequate answers to the Permanent Commission of the 1946 Convention.

The special meeting on Asdic and Echo-Sounding received five papers ; it is intended to publish a number of papers on this subject as a special number of the *Rapports et procès-verbaux des réunions*.

At the 1954 meeting, which will take place in Paris, commencing 4 October, there will be three special meetings, as follows :

- (i) Oyster and Mussel Culture.
Convener : Dr. B. Havinga. Rapporteur : Dr. H.A. Cole.
(To be held towards the end of the Council Meeting)
- (ii) The Problems and Methods of Sampling Fish Populations.
Convener : Mr. G. Rollefson. Rapporteur : Mr. B.B. Parish
(or another at the discretion of Mr. Rollefson)
- (iii)^{*} Herring Tagging Techniques and Results.
Convener : Dr. W.C. Hodgson. Rapporteur : Mr. O. Aasen.

The observer at this meeting on behalf of FAO and the IPFC was Dr. G.L. Kesteven who, in thanking the Council at the final session, made the following statement :

In FAO, we recognize that in recent years some very significant changes have taken place in the fisheries world, and, being impressed with the importance of these changes, we thought it desirable to speak of them to this Council. I should like to refer to three of them ; firstly, the recently awakened, and now very considerable, public interest in matters concerning the waters of the world ; secondly, the technical changes which have taken place in the exploitation of the aquatic resources ; thirdly, the growing stature of fisheries science.

In speaking of awakened popular interest in the seas I am not thinking only of the phenomenal sales of Rachel Carson's book, nor of the popularity of underwater swimming with the aqualung, although these represent an important aspect of the matter. I refer more particularly to the fact that the world at large seems at last to have become aware that although the aquatic resources provide now only a small proportion of man's food supply this need not be so but, on the contrary, these resources ought to produce a great deal more. An attempt was made at the UNSCCUR* meeting to form some idea of what this future role of these resources might be ; we, in the Fisheries Division of FAO, have recently made a revision of that survey and perhaps our main conclusion was that there is every reason to believe, from biological and technological considerations, that production from aquatic resources could, in terms of present forms of production, be increased even more than FAO's 1951 estimate of two- or three-fold, whilst in terms of novel utilization this increase could be several-fold. It is all part of the picture that many under-developed countries are looking for substantial development of their fisheries as an important element of their expanded economies. In contrast with this rather optimistic view, we are forced, however, to take cognizance of the fact that production increases are not taking place as quickly as the food situation would seem to demand, and the resources and techniques would allow, and that in fact there are numerous factors, many of them socio-economic, which

* United Nations Scientific Conference for the Conservation and Utilization of Resources.

restrain development. Such difficult matters as incentive, education, consumer-preference and industrial organization, bedevil every administrator who has a charge to secure development of his country's fishery industries. It is part of our thesis that in the new situation of fishery science one of the tasks is to achieve a balance between the somewhat more attractive work in biology and technology, on the one hand, and that which must be done on these more recalcitrant problems on the other.

In respect of the first important change, then, there are two major aspects. One is: How are we to improve our estimate of the aquatic resources and their potential productivity, and at the same time our understanding of these resources and how may they best be exploited? The second is: How are the impediments to development to be removed? The first aspect is faced by the second major change to which I referred, namely, the technical changes in exploitation. Here I refer not so much to improvements in design of fishing craft, to radio, echo-sounding, asdic and new kinds of gear, as to the fundamental fact that these are giving us the means by which to employ our knowledge of fish stocks (their distribution, abundance and behavior) in a way which will convert fishing from the hunting stage into a kind of animal husbandry. These improvements obviously are reducing the risk element in fishing, a reduction which is carried further by the development of biological prediction systems. What is less obvious perhaps is the effect upon the young new science, fishery science, of this exercise of its muscles and acceptance of responsibility. We believe that fishery science is now emerging as a distinct, autonomous science analogous with agricultural and veterinary science, whilst at the same time its capacities are being subjected to undue strain. In claiming the emergence of fishery science we would make certain stipulations: firstly, that this science has at least three parts, namely, fishery biology, fishery economics and fishery technology (or engineering, if you prefer) we are not sure, but we suspect that there is also a distinct field of fishery oceanography; secondly, that fishery biology is not to be equated with marine biology or limnology, nor is it to be held to comprehend the whole of the science; thirdly, that the function of the science is not only to propose conservational restrictions upon fishing activity, but rather it is to give assistance in the broadest sense — this may perhaps be signified by the term 'fishery management' which includes the appraisal of under-exploited stocks and the finding of new ones, and the formulation of plans for their better exploitation.

You may ask why I speak of these things to you who know them well, and the reply is that I speak of them as a whole, not as separate propositions, for it is our impression that the failure to see and speak of these matters as a whole is responsible, in part at least, for certain of the difficulties with which fishery workers around the world are confronted. There are not enough fishery workers, and there are far too few separate skills among them. Too much or too little is expected of them; most often, too much, and the fishery biologist is generally expected to be a worker of miracles. The dearth of workers is caused by lack of direct educational facility and by lack of professional opportunity — and this situation arises from a lack of recognition of the need for specially trained people, as well as from the serious confu-

sion of marine biology and limnology with fishery science by way of an identification of the latter with fishery biology. Thus, we believe that there is urgent need not only to increase the educational facilities for fishery science, but also to subdivide and stabilise its curriculum.

It is for this reason, Mr. President, that we ventured to ask to be able to take up some of your Council's time. Fishery science was born here, and suffered here the vicissitudes of its adolescence: we think that most probably it will graduate here. We believe also that the Council's knowledge of fishery resources and its experience in matters concerning their exploitation will enable it to take a lead in the conversion of fish-hunting to fish-husbandry and in all which that will mean in bringing new areas and new resources under exploitation.

The Council, whose honorary president is Dr. K.A. Andersson, unanimously re-elected A.T.A. Dobson, United Kingdom, as its president for the year 1953/54. The other members of the Council are: First Vice-President, Professor J. le Gall, France; vice-presidents, G.J. Lienesch, The Netherlands, Professor H.U. Sverdrup, Norway, and Dr. Å. Vedel Tåning, Denmark. The Council having decided that, if its interests are to be best served, the General Secretary must be a scientist, appointed Arni Fridriksson, M.A., Iceland, to succeed the present General Secretary, Villy Dessau, Denmark, on his retirement on 1 January 1954.

International Whaling Commission

The Commission held its fifth meeting in London at the offices of the Ministry of Agriculture and Fisheries, 22-26 June 1953. The commissioners, with the experts and advisers and various observers, were welcomed by G.R.H. Nugent, M.P., Joint Parliamentary Secretary to the Ministry of Agriculture and Fisheries, who expressed his gratification at again having an opportunity of meeting the Commission and wished all assembled success in their great task in conservation of the whale stocks.

Commissioners were present from Australia, Brazil, Canada, Denmark, France, Iceland, Japan, The Netherlands, New Zealand, Norway, Panama, Sweden, Union of South Africa, U.S.S.R., the U.K. and the U.S.A. Mexico was not represented. Also present were observers from Argentina, Italy, Peru, and FAO, the International Council for the Exploration of the Sea (ICES) and the Association of Whaling Companies.

The first order of business was the approval of the agenda and the following committees were appointed:

Scientific Committee: Australia (J.E. Cummins), Brazil (an observer), Canada (G.R. Clark), Denmark (P.F. Erichsen), France (Dr. P. Budker), Japan (Dr. H. Omura), The Netherlands (Dr. E.J. Slijper), Norway (Prof. B. Bergersen), South Africa (Dr. J.M. Marchand), the U.S.S.R. (V. Tverianovich), the U.K. (Dr. N.A. Mackintosh),

the U.S.A. (Dr. R. Kellog), with the addition of experts. At the first meeting of this committee, held after the first plenary session, Dr. N.A. Mackintosh (U.K.) was elected chairman.

Technical Committee: Australia (G.R.B. Patterson), Canada (G.R. Clark), France (A. Martin), Japan (S. Hori), The Netherlands (H.S. Drost), Norway (H.Th. Knudtzon), S. Africa (Col. R.L. Gouling), the U.S.S.R. (Capt. A.N. Solyanik), the U.K. (R.G.R. Wall), the U.S.A. (Dr. J.L. Kask), with the addition of experts. G.R. Clark (Canada) was elected chairman.

Finance and Administration Committee: R.G.R. Wall (U.K.) Chairman, Dr. P. Budker (France) and Dr. J.M. Marchand (S. Africa).

It fell to the task of these committees to lay the foundation for most of the substantive work to be accomplished. Great interest was shown on the part of all delegates and various points of view were presented.

The Commission had before it in the usual form the detailed figures supplied by the International Bureau of Whaling Statistics relating to the whaling season of 1952 (land stations) and 1952/53 (pelagic season). As regards the pelagic season there were 16 expeditions with 232 whale catches and a total production amounting to 1,994,760 barrels of oil. The land stations produced 119,865 barrels making a grand total of 2,114,625 barrels inclusive of 120,457 barrels of sperm oil. This output represented a decrease of 362,773 barrels from the previous year. Outside the Antarctic, the output in the year 1952 was 427,715 barrels as compared with 656,426 barrels in 1951, and at 6 barrels to the ton represented 109,404 tons.

It was noted by the Commission that pelagic whaling in the Antarctic was stopped at midnight on 16 March 1953 by which time 14,855 blue whale units had been taken, which was less than the authorized limit of 16,000 units. Provisions were adopted by the Commission, on the recommendations of the Technical Committee, seeking to prevent this short fall of the take from that which is allowed by requiring that the Bureau of International Whaling Statistics notify each contracting Member Government and each factory ship of the catch at the end of each day, after a level of 14,000 blue whale units have been reached.

The Technical Committee and the Scientific Committee held separate and joint meetings. Arising from the reports of these committees a number of decisions were taken and suggestions were made for the modification and amendment of the schedule to the Convention as a result of the work of a special drafting committee. These rearrangements and amendments will be submitted to each contracting government for their assent so that the schedule may become effective. In general, the alterations and amendments dealt with have the effect not only of removing certain ambiguities and general tidying up of the

document, but also lean in the direction of procuring further protection for the whale stocks.

Discussions in the Scientific Committee were greatly aided by the results of two scientific sub-committees set up to consider: (1) the question of humpback whales, and (2) the question of sanctuaries and the 16,000 blue whale unit limit respectively. These sub-committees were appointed by the 4th meeting and met under the chairmanship of Prof. B. Bergersen in Stockholm in March 1953. It was unanimously agreed by these sub-committees, and concurred in by the main committees, that there is still a great dearth of scientific data upon which conservation measures could be soundly based and that special attention should be paid to a more intensive program of whale marking and that governments should be encouraged to intensify the collection of data on the biology of whales.

With respect to the humpback whale, the sub-committee noted that it had long been recognized that this whale is particularly vulnerable and could be quickly depleted. The humpback received complete protection in the Antarctic until 1949; since then, the take has been limited to 1,250 animals. The take of land stations, apart from the seasonal and length limitations, are not restricted and here again the committees urged that the governments concerned give consideration to the voluntary limitation to the take of humpbacks at land stations. They attached much importance to such voluntary limitations and understood that the suspending of whaling in French West Africa is contemplated, just as whaling in the waters of Madagascar was recently suspended. In the absence of a sufficient body of scientific evidence as to proper ways of securing the maintenance of stocks, and being mindful that this species may, in coming years, be seriously depleted, the sub-committee recommended that the killing of humpback whales be permitted in the Antarctic only on the 1st, 2nd 3rd and 4th of February. It was thought unlikely that the previous limit of 1,250 would be reached during this period and thus a small measure of protection would be afforded.

It was the unanimous opinion of these committees that the data already available on blue whales showed that this species required further protection if the stocks were to be maintained, but that this question must be considered in conjunction with that of the fin whales. The committees noted that although the catch of fin whales had increased continuously consequent upon the reduction in the catch of blue whales, it had no definite proof of the depletion of fin whales, but it was felt that any further protection offered to the blue whale would result in a further catch of fin whales unless the total number of units allowed (16,000) were reduced. It was considered unwise to allow this to occur and hence the committees recommended a reduction in the total number of units permitted.

After the above considerations had been discussed at joint sessions of the Scientific and Technical Committees, a meeting of the full Commission decided to recommend to the Member Governments that additional protection should be given to the blue whale by forbid-

ding their capture south of 40° South Latitude until 16 January and that a reduction be made in the total permissible take of all whales in the Antarctic from 16,000 blue whale units to 15,500.

The Commission unanimously decided to continue the sub-committee to the Scientific Committee under the chairmanship of Prof. B. Bergersen, other members being scientists from Australia, France, The Netherlands, Japan, Norway, the U.S.S.R. and the U.K. The sub-committee will be convened in Stockholm in 1954 *inter alia* to examine and report upon the progress of research on the stocks of humpback whales, to study the catches of pelagic factories and land stations, to examine the catch figures of blue and fin whales in the Antarctic in relation to the measures of conservation which have been recommended and to consider and report upon the recent increased catches of sperm whales in certain areas.

Among other matters the Committee on Finance and Administration considered the suggestion that the Commission meet biennially instead of annually. It was their view, however, with the current position of whale stock conservation it would be unwise, at present, to alter the practice of holding a commission meeting annually. The Committee also recommended that the sum requested from each contracting government in respect of the year 1953/54 should be maintained at its previous level of £150. The net cost of the Commission for this year is estimated at £2,890. All these recommendations were endorsed by the Commission which decided that the 1954 meeting should open on 19 July 1954, in Tokyo, on the invitation of the Japanese Government.

Fisheries Division Activities

International Fishing Boat Congress

FAO, in co-operation with the Ministère de la marine marchande, arranged an International Fishing Boat Congress in Paris from 12 to 16 October 1953. This will be followed by a similar Congress, to be arranged in co-operation with the United States Fish and Wildlife Service, in Miami, Florida, U. S. A. from 16 to 20 November.

Sixty-six technical papers were submitted at the Paris session and a total of 200 participants from 24 different nations were registered. Representatives from the International Labour Office, the World Meteorological Organisation and the International Commission for the Northwest Atlantic Fisheries were also in attendance.

The Congress was opened by Jules Ramarony, Secrétaire d'Etat à la marine marchande, who was elected Honorary Chairman. Commander A. C. Hardy of the United Kingdom was elected Chairman

of the Congress and the following were elected chairmen of the individual technical sessions :

Boat Types	Commander A. C. Hardy, London
Hull Shapes, Sea Behavior	Dr. J. Dieudonné, Directeur général de l'Institut de recherches de la construc- tion navale, Paris
Stability, Safety at Sea	Dr. James F. Allan, Superintendent, Ship Division, National Physical Laboratory, Teddington, England
Engines, Propellers	Dr. Messiez-Poche, Président de la Commission tech- nique du Syndicat français des constructeurs de moteurs, Paris
Deck Gear	Dr. G.G. Bordoli President, Rome Section, Associazione Italiana di Tecnica Navale, Rome
Economics, Research Vessels	R.A. Harvey, Director, Fishing Vessel Construction, Department of Fisheries and Co- operatives, St. John's, Newfoundland
Factory Ships	H.C. Hanson, Consulting Naval Architect, Seattle, Washington, U.S.A.

The papers, which had been distributed in advance, were summarized by rapporteurs in order to provide as much time as possible for discussion. Authors were given the opportunity to add to the rapporteurs' summaries.

Jan-Olof Traung, FAO Naval Architect, acted as rapporteur for the session on " Boat Types " and summarized 24 papers on this subject. The discussion which followed centered on problems of general arrangement, construction methods, use of wood, steel, aluminum and other materials and the question of beach landing craft.

Dr. Brard, Ingénieur en chef du génie maritime, Chef du Bassin d'essais des Carènes de la marine, Paris, acted as rapporteur for

the "Hull Shapes and Sea Behavior" Section. Dr. J. F. Allan, Director of the Teddington Tank, Dr. W. P. A. van Lammeren, Superintendent, Netherlands Ship Model Basin, Wageningen, N. Chr. Astrup, Skipsmodelltanken, Trondheim, R. E. Gueroult, Consulting Naval Architect, Paris, and many others participated in the discussion. In conclusion, the participants urged FAO to continue its work in compiling the results of tank tests on fishing boats and to publish them in a uniform style for the benefit of fishing boat designers in various parts of the world. It was also stressed that FAO should encourage and co-ordinate research especially on the subject of sea behavior.

Prof. G. Schnadel, Chairman of the Schiffbautechnische Gesellschaft and President of Germanische Lloyd, Hamburg, acted as rapporteur for the papers dealing with stability and safety at sea. It was evident from the discussion that even though quite strict stability and safety regulations for fishing boats existed in some countries, they were totally non-existent in others, such as the United States. The possibility of formulating minimum stability criteria necessary for fishing vessels was discussed at some length, but the meeting felt the question of such importance that it would require further study before any definite recommendations could be made.

Commander A. C. Hardy, London, acted as rapporteur for engine and propeller questions. In addition, some papers were summarized by the chairman, M. Messiez-Poche. The meeting was divided on questions of 4-stroke *v.* 2-stroke engines, slow-running *v.* high-speed engines, engine types such as semi-Diesel *v.* Diesel, method of drive such as direct drive, Diesel electric or controllable pitch propellers. The discussion was extremely lively and all the different types of propulsion machinery were defended. An unexpectedly large number of participants proved to be advocates of the semi-Diesel engine as being a heavy duty engine in sizes below 250 h.p. requiring a minimum of maintenance. Very interesting also was the information given on controllable pitch propellers as not being a new invention, but a type of propulsion which had been used in Scandinavia almost since the introduction of engines in fishing boats.

The papers on deck gear were summarized by Hilmar Kristjonsson, FAO Fisheries Engineer, who, for the main part, dealt with the use of hydraulics for the driving of winches, etc. Seamus O'Meallain, Chairman, An Bord Iascaigh Mhara, Dublin, Ireland, reported on two economic papers and emphasized especially the need for a good accounting system in boat building establishments.

Captain H. Bertram, of the Bundesministerium für Ernährung, Landwirtschaft und Forsten, Hamburg, Germany, reported on research vessels and gave a description of a new German research vessel under construction. Additional information about a Yugoslav research vessel was given by P. Mardesič, Naval Architect, Split, and about British research vessels by T.S. Leach, Chief Inspector of Fish, London.

Mogens Jul, Chief Fisheries Technologist of FAO, reported on factory ships. He was rather doubtful of the immediate future of this

type of fishing enterprise except under such conditions where distance from home ports makes other types of operations impossible. He pointed out that while factory ships can be made economically and technically successful under optimal conditions, there will always remain in use other kinds of fishing boats in varying sizes and that it was important not to consider factory ships as superseding other kinds of fishing boats. Commander A. C. Hardy, London, L. M. Harper Gow and W. Lochridge, both of Leith, Scotland, talked on the subject of factory ships and a lively discussion followed.

The Paris session was closed by the Minister, Jules Ramarony, and the French delegation suggested that the work started by the Congress should be continued in some way. A resolution was adopted to this effect and a number of the participants was elected to an *ad hoc* committee to study the possibilities of arranging another Congress of this nature and other questions relating to international co-operation in this field.

There have been many requests for a full report containing all the technical material from the papers and discussions from the meeting. FAO has no funds from which such a publication could be made. Therefore, the Organization has accepted an offer from a private publisher — Arthur Heighway Publications Ltd., 68 Victoria Street, London, S. W. 1. — who will arrange to have the material printed in English as a book which will be sold through ordinary trade channels.

Interim Committee on Fish Handling and Processing

Recognizing the need for improving the quality of fish and fish products to stimulate consumption and the inadequacy of existing methods of testing the freshness of fish, the Interim Committee called together a group of fisheries technologists to explore the feasibility of setting up a working group on freshness tests to provide those in charge of quality control with a tool or tools for measuring quality and possibly to facilitate formulation of common quality standards for export of fish and fisheries products. The group, which met on 6 and 8 September 1953 in Rome, Italy, consisted of Dr. E. Hess (FAO), Chairman; Dr. G. N. Subba Rao (FAO), Secretary; Dr. D. B. Finn (FAO); S. Hjörth-Hansen (Norway); P. F. Jensen (Denmark); J. Liston (U. K.); A. F. M. G. Luijpen (Netherlands); and Dr. J. M. Shewan (U. K.).

After discussing the possible extent of the work, the various tests in use in different countries for different fisheries products, and consumer preferences, the meeting recommended to the Interim Committee that the formation of a working group was a most desirable move in order to make an objective study and evaluation of freshness tests on a broader level of international co-operation and thus give promise of more rapid progress than is possible in the work of individual laboratories working independently.

Terms of reference for the work of the proposed Group were drafted and submitted to the Interim Committee. These provide that the group first explore the possibilities of having common official tests and that, at a later stage only, quality standards, based on such tests, might be recommended to the various governments for adoption. The immediate task of the group would be to collect all the literature on the subject of freshness tests, choose one or two of the most suitable methods and investigate them in different countries.

The Working Group on Chilling of Fish met in Rome, Italy, on 14 September 1953. Attending were H. Riemann (Denmark), Acting Chairman ; Dr. E. Hess (FAO) ; S. Hjörth-Hansen (Norway) ; J. Liston (U.K.) ; A.F.M.G. Luijpen (Netherlands); and Dr. J.M. Shewan, (U.K.). The Group discussed the draft report "Chilling of Fish", which was mainly a literature survey on experiments concerning handling, chilling and the application of preservatives. Written comments were received from W.J. Dyer (Canada), M.E. Stansby (U.S.A.), and combined comments from the Ministry of Food and the Torry Research Station (U.K.). The report and comments were reviewed and some additions were made to the literature list. In reviewing its work, the Group emphasized the need for keeping each other informed not only of material published, but also of research in progress and planned. A report of general interest to the Group, "Handling of Wet Fish and Fresh Fish Fillets in Denmark", was submitted by F. Bramsnaes and E.W. Hansen.

Regional Fisheries Office for Latin America

Dr. B.F. Osorio Tafall gave a course in fisheries at the Winter School of the University of Chile at Antofagasta. While there he, along with J. Fridthjof, FAO/ETAP expert, and Dr. Virginio Gomez, of Chile, surveyed the local fishing industry and held meetings with governmental and private persons interested in fisheries. Dr. Osorio Tafall also gave assistance to the Chilean State Technical University in planning courses in fisheries technology.

The Chilean National Food Department, in co-operation with officers of the Nutrition and Fisheries Divisions of FAO, is investigating the possible use of fish flour for human consumption. Samples of fish flour are being analyzed and acceptability tests and experiments in its use are being conducted. In addition, portions of bread made with fish flour are being served to 100 school children daily.

In an effort to improve the distribution of fish in Tomé and neighboring places in Chile, the town of Tomé is considering ways and means of building an ice factory and cold storage warehouse. Recently H. Rosa Jr., J. Fridthjof and Dr. Gomez visited the area to advise on this project. Some advice was also given on a project for the construction of a fish terminal in Talcahuano, Chile.

Papers have been assembled for the Eighth Pacific Science Congress to be held at Quezon City, in the Philippines, 16-28 November 1953. These include :

- "The Fisheries of Chile," by Dr. Osorio Tafall,
- "Fishery Research Institutions in Western Latin America," by H. Rosa Jr.,
- "Abnormal Summers in the Peruvian Coastal Current," by Dr. Erwin Schweigger,
- "The Hake Fishery of the West Coast of Chile," by Dr. Erik M. Poulsen, and
- "Preliminary List of Chilean Fishes and their Vernacular Names," by Dr. Fernando de Buen.

Other papers, translated into English and edited by the staff of the Regional Office, included : "Report on the Algae of the Chilean Seas," by Hector Etcheverry D. and "Edible Shellfish of the Chilean Coast," by Francisco Riveros Zúñiga. A brief report on the oceanographic activities of the countries of the South American slope, including the work of FAO in that region, was sent to the Secretary of the Oceanographic Group to be included in a general report on the progress of oceanography in the Pacific area.

The Latin American Center of Scientific Co-operation of UNESCO invited FAO to collaborate in implementing the recommendation of its Advisory Committee that appropriate steps be taken to create a network of international marine biological laboratories, to be organized in Latin America. Mr. Rosa and Dr. Osorio have prepared a paper reviewing international collaboration in marine biology, possible types of international collaboration in Latin America, the proposed oceanographic research institute for the Indo-Pacific (see *FAO Fisheries Bulletin*, Vol. 6, No. 5, p. 207), recommended action to be taken on the organization of marine biological laboratories in Latin America, the activities of the FAO Regional Fisheries Office for Latin America, and giving a list of marine biological and oceanographic institutions and laboratories in Latin America. UNESCO is planning to call a meeting of specialists in this field in Santiago, Chile, to discuss further action on this project.

Regional Fisheries Office for Asia and the Far East

Pre-Conference Regional Meeting

R. Serene, Chairman of the Indo-Pacific Fisheries Council, and Dr. C. Miles, Secretary, attended the FAO Pre-Conference Regional Meeting in Bangalore, India, from 27 July to 5 August 1953. The Chairman called the attention of the Meeting to the special place that fish occupies in the diets of the peoples of South and East Asia and it was agreed that the improvement of fishing methods and the elimi-

nation of waste should not be neglected. It was stressed that fish is a highly perishable commodity and that the conditions under which it is marketed leave much to be desired in many areas. Improved transport and low temperature storage are also essential since any improvement in landings at the fishing ports would only be useful if the fish could reach the inland areas; otherwise the net result might merely be a local glut and low prices for the fishermen. It was apparent that much remained to be done in fisheries development and that this could be achieved only through the training of expert fisheries administrators. It was also necessary to educate the fishing operatives in the use and maintenance of mechanized boats and gear.

A resolution was passed to the effect that special attention be given to the organization of an FAO-sponsored training course in mechanized fishing.

The Meeting, noting that 80 percent of the world consumption of fresh-water fish occurred in the region, recommended that governments should continue to give attention to the development of fish culture in inland waters, including rice fields. A resolution was passed recommending that the possible threat to the important inland fisheries, from irrigation and electric power schemes, should be taken into account and the harmful effect of pollution of waters by factory wastes in an increasingly industrial economy required immediate remedial action.

With regard to the sea fisheries, it was believed that there were many aspects which required a more adequate study than had previously been possible and many of these problems were common to several governments. The periodic failure of certain fisheries, such as the oil sardine (*Sardinella longiceps*), mackerel (*Rastrelliger kanagurta*) and hilsa, were cited as examples and it was suggested that the international work initiated by the Indo-Pacific Fisheries Council in the collection and dissemination of information should now be implemented in a practical way by the organization of co-ordinated international research. A resolution was passed recommending that FAO direct its Expanded Technical Assistance Program in this direction.

The work being done by governments, with FAO and other assistance, towards the improvement of local fishing boat design and the introduction of non-indigenous craft and gear was noted, as were the steps being taken for the planning and construction of improved fishing harbor facilities.

The meeting was concerned at the low economic status of the fishermen in many parts of the region and it was agreed that rational methods of financing with government assistance, the formation of fishermen's co-operatives and the introduction of proper marketing would go far to ensure that the operatives receive a fair share of the retail value of their produce.

Finally, it was agreed that the fisheries administrations, which are at present in the formative stage in many countries, could perform their functions of assessing the requirements of the industry only if reliable statistics were available, including some estimate by sampling methods of the considerable subsistence fishing operations.

Visit to Madras and Calcutta

During his return trip from Bangalore, Dr. Miles visited Madras and Calcutta for discussions with fisheries officials. In Madras, he visited the fish markets and a fishing village where the Directorate of Fisheries has been instrumental in the organization of a quasi-co-operative society for which it provides transport to Madras City. In Calcutta, he gave an address at a symposium organized by the Director of Fisheries, and held discussions with officials of the Zoological Society of India and others concerned with fisheries.

Personnel

As announced in the *FAO Fisheries Bulletin* (Vol. 6, No. 3, p. 97) Mogens Jul, Chief of the Technology Branch of the Fisheries Division for the past five years, has resigned to accept a position as Director of Research Development with the Joint Board of Co-operative and Private Packing Houses of Denmark. Mr. Jul is a graduate in chemical engineering, specializing in food technology, of the Royal Technical University and, prior to joining FAO, was Director of the Research Laboratory of the Department of Fisheries of Denmark and an instructor at the University. He was also Co-Director of the Food Preservation Laboratory of the University and Head of the Chemical-Biological Department of the Danish Institute of Refrigeration.

Mr. Jul's connection with FAO dates back to 1945 when he was a member of the Danish Delegation at the FAO Conference in Quebec, Canada. He was also a member of the same delegation at the FAO Conference in Copenhagen in 1946.

During his assignment with FAO, Mr. Jul organized the Technology Branch of the Fisheries Division; he initiated the publication of the *World Fisheries Abstracts* and was in charge of advisory and technical assistance in fishing methods and gear, improvement and mechanization of fishing craft, fish handling and processing methods (in this connection he organized a meeting of experts to consider her-ring technology in Bergen, Norway, in 1950) and assisted in organizing the Interim Committee on Fish Handling and Processing of which he was secretary. He also surveyed the fisheries of Latin America and lectured at the Latin American Fisheries Training Center.

He is the author of numerous publications on food technology and the world food situation, and member of the Danish Academy of Technical Science.

H.C. Winsor resigned effective 21 September 1953 to accept an appointment as a member of the Newfoundland Fisheries Development Authority, which was recently established to further the development of the Newfoundland fisheries. This is in accordance with the recommendations of the Newfoundland Fisheries Development Committee, established by the Governments of Canada and Newfoundland in January 1951, to study the fishing industry of Newfoundland with a view to

the more effective utilization of the fisheries resources "through methods of fishing and processing based on sound scientific, economic, and social considerations".

Mr. Winsor has been Executive Officer of the Fisheries Division since its formation in 1946. He is a graduate in business administration of Boston University, Boston, Mass., U.S.A.; from 1939 to 1943 he was with the Newfoundland Fisheries Board which was entrusted with the coordination of the marketing of fisheries products, and from 1944 to 1946 was Secretary of the Committee on Fisheries Products of the Combined Food Board (later the International Emergency Food Council) in Washington, which supervised the allocation of food supplies among allied nations during and immediately after World War II.

Jean Bosly has joined the Office of the Director as Executive Officer of the Fisheries Division, following H.C. Winsor's resignation. Formerly, from June 1952, he was attached to the Organizational Methods Section of FAO Administration.

Expanded Technical Assistance Program

Requests for continuing existing ETAP projects and starting new ones in other countries in 1954 are under review in the light of foreseeable funds available to the Program. Government requests for technical assistance in fisheries development in 1954, received by 31 August 1953, have come from 35 countries and involve 91 experts, 49 fellowships, and three training centers. The estimated cost to implement these requests is \$1,800,000.

The following is a summary of progress in FAO technical assistance projects in fisheries as of 1 September 1953.

British Guiana. The government fisheries officer, who was awarded a fellowship in inland fisheries and fish culture, will shortly conclude his studies in Brazil and leave for Haiti where he will visit the fish ponds established by the Government on the advice of ETAP experts in that country. His experience in Brazil with species of fish indigenous to his own country has been valuable. He will then proceed to Europe and Indonesia.

Ceylon. The program of Alan Glanville, of the United Kingdom, has stimulated a keen demand among local fishermen for small Diesel or semi-Diesel engines. The success of this work has attracted the attention of the Australian and Canadian Colombo Plan Organizations. Sixty small inshore motor boats and a considerable number of engines are being considered for inclusion in the supply program from those countries. E.R. Kvaran, of Iceland, working closely with Glanville, is engaged not only in supervising the actual installation of engines provided by FAO into local fishing craft, but also in assisting the Government in planning procedures for the training of fishermen in their

running and maintenance, and workshop facilities to which the fishermen can turn for overhaul of the engines. Both officers spend a great deal of time at sea with the fishermen, demonstrating how to get the best use out of the engines and how the use of power enables the fishermen to work further afield, reduce time in passage to and from the fishing grounds, land fish in better condition, and work more gear, such as long lines, gill nets, etc.

Chile. The Government has contributed half the cost of a further extension of the present assignment of J. Fridthjof, of Denmark, to enable him to complete the current phase of his project to increase the consumption of fish in Chile. Dr. de Buen, of Mexico, has visited northern Chile to assist the Government in plans for developing the fisheries resources in this section of the coast line.

Dominican Republic. Thirteen nursery ponds covering 8 $\frac{1}{2}$ acres have been constructed by the Government on the advice of S.Y. Lin, of China, and three more ponds covering 10 acres are planned. Fish in various stages of development have been established in the ponds already constructed. Ponds established elsewhere in the country for growing fish will eventually be stocked with fingerlings bred from these nursery ponds (see also p. 234).

Ecuador. Dr. E. Schweigger, of Peru, is continuing at the Santiago FAO Regional Office, the preparation of a report on his work of assessing the fisheries resources in Ecuador, and in reviewing available knowledge on this subject.

Finland. T. Kaartotie, Deputy Councilor of the Division of Fisheries, has completed his study of administration and management of marine and fresh-water fisheries in the U.S.A. and Canada under an ETAP fellowship. Another Fellow, O. Nikkila, spent three months in the U.S.A. and Canada to study canning, preservation, and quick-freezing of fish and the use of fish by-products and wastes.

Haiti. Shimon Tal, of Israel, has developed enough stock in nursery ponds to enable 9,000 *Tilapia* to be released in various rivers and lakes in the country during the last months; a further 4,500 carp fingerlings have been released in the Artibonite river. A number of small ponds near Port-au-Prince have been stocked, and one larger fish farm has also received its initial stock from the nursery. The Punten carp from Java are acclimatized and being prepared for breeding; a shipment of a fast-growing strain of carp has arrived in fine condition from Israel (see also p. 231.)

India. W.F.L. van der Heyden, of The Netherlands, is concluding his work in the delta of the Ganges on the improvement of fishing methods and will report to Rome early in September. P.B. Ziener, of Norway, has reported to Rome for briefing prior to taking up his assignment as a naval architect under a project to improve the types of fishing vessels now in use and to develop new types of fishing craft

suitable for mechanization. It is hoped to recruit a fishery engineer from Iceland this year to work on gear technology and small craft mechanization in the State of Madras.

Iraq. A. van den Eelart, of The Netherlands, completed his assignment and his report is being prepared for submission to the Government.

Israel. The pond fish culture project of A.E. Hofstede, of The Netherlands, is entering its final phase, and he is due to report to Rome in September. Two Israeli Fellows have studied fishing methods and gear in Italy. One of these is now in Holland where he is studying trawling and other methods for catching ground fish, while the other is in Greece studying Mediterranean methods of catching pelagic fish.

Liberia. Jan van Pel, of The Netherlands, fish preservation technologist, returned to Liberia in August after home leave. Meanwhile, H. van Pel has returned to Holland on medical advice, and it may be some time before he will be able to resume duty. Jan van Pel will, therefore, carry on both his own and his brother's program of work in mechanized fishing in small craft. The latter program has received a setback due to a mishap to the 24-foot fishing boat in use and it may be some time before the damage is repaired.

Pakistan, West. Kurt Ohlsson, of Sweden, has been compiling the records collected in the country earlier this year by K.H. Magnusson and arrangements have been made to have scale models of three types of local fishing craft tank-tested in Sweden.

Panama. Leslie Scattergood, of the U.S.A., has enlisted the co-operation of two research teams from the United States to develop his program of investigation into the biology of the shrimp. He is also establishing an improved system for the collection of statistics in order to estimate the scope, trends, and fishery load of the commercial shrimp industry.

Saudi Arabia. The report of Dr. M.K. el Saby, of Egypt, on his exploratory fishing program in the Red Sea waters of Saudi Arabia is now in preparation. The country has asked for further technical assistance in 1954 and it is hoped, funds permitting, to furnish the services of a commercial fisheries consultant to advise the Government's Fisheries Development Company, which is about to be established as a result of Dr. el Saby's work.

Somalia. W.H. Ogilvie, of the U.S.A., and A. Fraser-Brunner, of the U.K., have now returned home on completion of their joint report on the work of the exploratory fishing carried out during the 1953/54 season. D. Byrd, of the U.S.A., is in Rome preparing plans for a resumption of work next season, for which it is hoped outside financial support can be obtained.

Thailand. The Government, through S.W. Ling, of China, is now distributing fish fingerlings to farmers at the rate of 450,000 per month. Dr. Ling is also conducting a number of public demonstrations of fish culture methods; one demonstration reached over 5,000 people, and another was conducted during a visit by the Minister of Agriculture. Dr. Ling has initiated some fresh experimental work in the cultivation of fish in rice paddy fields (*see also* pp. 228-29).

Turkey. The Government of Turkey, through the Meat and Fish Office, are going ahead with the construction of a fish meal and oil factory in the Trabzon area, and it is understood that orders are in preparation for the machinery. All four of the FAO/ETAP fisheries team of experts have helped with this development. In addition, each expert is developing his own program of work; Dr. G.A. Rounsefell, of the U.S.A., in fisheries biology; Dr. Thor B. Lexow, of Norway, in fish meal and oil technology; Helgi Bergs, of Iceland, in fish freezing and the cold storage of fish; and George Napier, of the U.S.A., in improving methods for capturing pelagic fish in the Black Sea. The Government is purchasing fishing gear in accordance with Napier's specifications. The fisheries economist from Norway should report to Rome on his way to Turkey late in September. The Government of Turkey has also invited FAO to conduct an international training center in fisheries biology in Istanbul during September-October. Training in modern techniques of biometrics and oceanography, which will be a feature of the training center, will greatly strengthen the fisheries investigations being conducted in Turkey and in some neighboring countries. In addition to the FAO/ETAP team, instructors are being sent from the United Kingdom.

Yugoslavia. Dr. W. Wunder, of Germany, is at present carrying out the third of his one-month missions in Yugoslavia, and is reviewing the progress made on his recommendations to control fish disease in fish farms. His recommendations are aimed at improving the practices of management in this important industry. W. MacCallum, of Canada, has completed a number of visits to fish cold store plants on the Dalmatian and Montenegrin coasts; he has made many suggestions for improving the efficiency of their operation and to ensure that the best use is made of the facilities available both for cold storage and the manufacture of ice. His short course of intensive training in fish refrigeration problems was attended by 18 Yugoslav fisheries officers and technicians, and was brought to a successful conclusion. The trainees were very keen and capable of absorbing the intensive training offered; plans were made for further instruction to be carried out by Yugoslav technical officers, and it is hoped that more permanent arrangements for instruction in this field will be made.

Notes on Publications

FWS 9.2 FISHERIES STATISTICS — FRANCE UDC 31:639.2(44)

France. Direction des pêches maritimes. Statistiques des pêches maritimes 1953 [MARINE FISHERIES STATISTICS], 1951. Imprimerie Nationale, Paris. 179 pp., tables. In French.

A brief annual report is followed by statistical material. Presents tables for the year 1951 compared with the years 1938, 1949 and 1950 covering landings by species in parts of Metropolitan France and Algeria, statistical details on the number of fishing craft, fishermen and fishing crews; and quantities and values of the 1951 fisheries production.

FWS 9.3 FISHERIES LAWS AND REGULATIONS — U.S.A. UDC 34:639.2(73)

Keefe, Ruth. COMMERCIAL FISHERY LAWS AND REGULATIONS. *Fishery* 1953 *Leaflet* 168. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. Revised June 1953. 7 pp. Mimeo. In English. Free.

A revision of an earlier issue, this brief statement on United States commercial fisheries laws and regulations covers federal laws and regulations and those of the fisheries agencies in the states, territories and island possessions, as well as inter-state and international commissions.

FWS 9.7 FISHERIES EDUCATION — CANADA UDC 37:639.2(71)

Saint Francis Xavier University. Extension Department. REPORT ON 1952 THE EDUCATIONAL PROGRAM FOR FISHERMEN OF THE MARITIME PROVINCES, YEAR ENDING 31 MARCH 1952. Antigonish, Nova Scotia, Canada. 20 pp. Mimeo. In English.

The annual report of the Extension Department of St. Francis Xavier University on its educational activities among the fishermen of eastern Canada for the year 1951/52 with an indication of the problems and a detailed progress report on certain areas.

FWS 9.1 FISHERIES RESEARCH, BIOLOGICAL — U.S.A. UDC 57(73)

United States Department of the Interior, Fish and Wildlife Service. 1953 SURVEY OF FISHERY ACTIVITIES 1953. *Circular* No. 21. Washington 25, D.C., U.S.A. 133 pp., mimeo. In English.

A catalogue containing information on the current programs of fish conservation, gathered from the principal agencies and institutions engaged in sport fish research and management activities in the United States. Preparation of the report was undertaken at the request of the American Fisheries Society. Encompasses work in progress to provide fishery administrators and technicians with information on modern developments in fish conservation practices. Lists 417 fish research and 66 fish management projects.

- Burlew, John S. ed. ALGAL CULTURE FROM LABORATORY TO PILOT PLANT. 1953. Publication 600. Carnegie Institution of Washington, Washington, D.C., U.S.A. ix + 357 pp., fig., illus., bibl., index. In English. Paper bound. Price : U.S. \$1.25.

A monograph presented in 22 papers by various authors, together with substantial bibliography on laboratory and pilot plant work in algal culture. The principal subject material discussed is *Chlorella*. In a foreword, V. Bush draws attention to the important possibility of algae culture as a major element of food production in the future. The monograph is in five sections; the first is an introduction and summary; the second deals with conditions for growth of algae, in which much attention is paid to the problem of illumination; the third, with growth of algae in mass culture, and the fourth, with pilot plant experiments. The final section deals with possible uses of microscopic algae.

FWS 6.3 SEAWEEDS — ADRIATIC SEA UDC 582.26(262.3)

- Ercegovič, Ante. Sur les *cystoseira* adriatiques — leur morphologie, 1952 écologie et évolution [ON THE ADRIATIC *Cystoseira* — THEIR MORPHOLOGY, ECOLOGY AND EVOLUTION]. *Fauna et Flora Adriatica*, Vol. 2. Institute of Oceanography and Fisheries, Split, Yugoslavia. 212 pp., illus., tables, bibl., map. In Serbo-Croat, with French summary.

Detailed study on the morphology, systematics and ecology of seaweeds of the genus *Cystoseira*. Under the systematics section each species is described in detail and fully illustrated.

FWS 6.3 PLANKTON — NORWAY UDC 593.1(481)

- Gundersen, Kaare R. ZOOPLANKTON INVESTIGATIONS IN SOME FJORDS 1953 IN WESTERN NORWAY DURING 1950-51. *Fiskeridirektoratets Skrifter, Serie Havundersøkelser* (Reports on Norwegian Fishery and Marine Investigations), Vol. X, No. 6. Director of Fisheries, Bergen, Norway. 54 pp., fig., tables. In English.

Reports investigations during 1950-51 on zooplankton in fjords south of Bergen and on the west coast of Norway. The occurrence and variation in number of different species of organisms is reported and discussed; particular attention is paid to copepods, but other crustacea are discussed as well as gastropods, chaetognaths, *Copepoda*, fish eggs and larvae. Variations in the composition, fat content and protein of the plankton are discussed, and observations are compared with previous work in this and other areas.

FWS 6.3 PLANKTON UDC 593.7

- Arnold, Edgar J. Jr., and Gehringer, Jack W. HIGH SPEED PLANKTON 1952 SAMPLERS. *Special Scientific Report: Fisheries* No. 88. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 12 pp., fig., illus. In English.

The first paper — "A High Speed Plankton Sampler (Model Gulf I-A)" by Arnold — is a preliminary note on a high speed sampler designed and constructed for collecting operations of the Gulf Fishery Investigations. The original sampler was cylindrical and consisted essentially of a marine plywood body housing a removable cylindrical wire cloth plankton net with detachable bucket and a current meter. A subsequent model was constructed entirely of monel metal. It is claimed that, although

This sampler superficially resembles the Scripps high speed plankton collector, it differs markedly in many respects, especially in operational procedure.

The second paper — "An All-metal Plankton Sampler (Model Gulf III)" — is also a preliminary note on an all-metal modified half-meter plankton net. It is stated that the sampler has principal disadvantages in its initial high cost and the awkwardness of handling the unit in rough weather because of its large size. A comparison with the conventional half-meter silk net, however, indicates seven important advantages relating to its durability, its catching and holding of the plankton and its operation.

FWS 1.85

CRUSTACEANS

UDC 595.3

Rasmussen, Birger. ON THE GEOGRAPHICAL VARIATION IN GROWTH AND SEXUAL DEVELOPMENT OF THE DEEP SEA PRAWN (*Pandalus borealis* Kr.). *Fiskeridirektoratets Skrifter, Serie Havundersøkelser* (Reports on Norwegian Fishery and Marine Investigations), Vol. X, No. 3. Director of Fisheries, Bergen, Norway. 160 pp., fig., tables. In English.

This study continues investigations begun by other workers in the 1930's. The present report covers the entire range of the biology of the deep sea prawn (*Pandalus borealis* Kr.) and makes use of previous material. It examines the life history of the prawn in a number of fjords, discussing in respect of each the prawn grounds, spawning and hatching, and age and rate of growth.

FWS 9.1

FISHERIES RESEARCH, BIOLOGICAL — U.S.A.

UDC 597(73)

Hile, Ralph. TWENTY-FIVE YEARS OF FEDERAL FISHERY RESEARCH ON THE GREAT LAKES. *Special Scientific Report: Fisheries* No. 85. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 47 pp. In English.

Presents an annotated bibliography of papers resulting from federal investigations on the Great Lakes fish and fisheries since the formal initiation of a continuing research program by the Fish and Wildlife Service. The bibliography is prefaced by an historical account of the program, including discussion of the funds made available for investigations. The bibliography lists nearly 200 papers, essentially the publications of the staff members of the Great Lakes fishery investigations. Papers resulting from work not associated with these investigations have been omitted as have also papers which remain in manuscript and various reviews and memoranda.

FWS 1.37

TROUTS

UDC 597.5

Moore, Harvey L.; Cope, Oliver B.; and Beckwith, Richard E. YELLOWSTONE LAKE TROUT CREEL CENSUS, 1950-51. *Special Scientific Report: Fisheries* No. 81. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 41 pp., fig. In English.

A detailed analysis of trout fishing on Yellowstone Lake over the period and estimates of the total catch by different units comprising private, guide and row boats and shore line fishing, were made. Estimates are given of the amount of effort expended in terms of number of days in the lake and of hours of fishing and the estimate of catch as related to the estimate in the takings of catch per fisherman hour. An appendix gives an account of the mathematical derivation of creel census estimates in the lake shore-line.

Mužinić, R. Remarques sur le développement et la croissance des otolithes
1952 de la sardine (*Clupea Pilchardus* Walb.) [OBSERVATIONS ON THE
DEVELOPMENT AND GROWTH OF OTOLITHS IN THE SARDINE (*Clu-
pea Pilchardus* Walb.)]. *Acta Adriatica* (Institute of Oceano-
graphy and Fisheries, Split, Yugoslavia), Vol. IV, No. 13. 22 pp.,
illus., bibl. In French, with Serbo-Croat summary.

Finds that the otoliths of young specimens can, for the same total
length, display difference of form, size and structure, and imputes these
differences to the influence of the period during which the fish have spawned.
Essentially a distinction is made between late and early spawned fish. The
otoliths of the late spawned fish are larger for similar total length of fish
than those of early spawned fish, whereas the early spawned fish have oto-
liths which are characterized by a large opaque zone around the hyaline
center.

FWS 1.2 HERRINGS, ETC. — NORTH SEA UDC 597.5(261.2)

Gilis, Charles. Observations sur les : A. Concentrations de harengs pleins.
1953 B. Concentrations de harengs guais 1952-53, exploitées par les
chalutiers belges (OBSERVATIONS ON : A. CONCENTRATIONS
OF MATURE HERRING, 1952, AND B. CONCENTRATIONS OF SPENT
HERRING, 1952-53). Institut d'études maritimes, Ostend, Belgium.
44 pp., tables. In Flemish and French.

Presents statistics on Belgian trawl fishing for herring, discusses
the fishery and biology of the stock and offers a forecast for 1953.

FWS 1.2 HERRINGS, ETC. — NORWAY UDC 597.5(481)

Aasen, Olav. THE ØSTERBØ HERRING. *Fiskeridirektoratets Skrifter, Serie*
1953 *Havundersøkelser* (Reports on Norwegian Fishery and Marine
Investigations). Vol. X, No. 7. Director of Fisheries, Bergen,
Norway. 34 pp., illus., tables, fig. In English.

Continuing his series of studies on races of Norwegian herring, the
author reports in detail on the Østerbø herring, a tribe occupying a very
small area and which the author concludes is not fully 100 years old and,
in all probability, derives from the winter herring. He believes that the
differences between the winter herring and the Østerbø herring are so slight
that the latter could hardly be described as a race. His study reports
vertebral number, length, weight, growth, maturity, quality and condition.

FWS 1

FISHERIES

UDC 639.2

Burnand, T. ; Naintré, L. ; Oddenino, C. and Laurens, M. La Pesca en
1952 el Mar [FISHING IN THE SEA]. Editorial Noguer, S.A., Barcelona.
Spain. 353 pp., illus. In Spanish.

Spanish translation of "La pêche en mer." Describes, in alphabetical
order, the most important European species of fish and shellfish of
commercial value, as well as the methods and gear used in their capture.
It also contains basic information on oceanography, meteorology, marine
terms, and many subjects of interest for the fresh-water fisherman.

FWS 6.9 CORALS — ADRIATIC SEA UDC 639.2(262.3)

Pax, Ferdinand, and Müller, Ingeborg. Die Anthozoenfauna der Bucht von Kašela bei Split [THE ANTHOZOA OF KASTELA BAY, NEAR SPLIT]. *Acta Adriatica* (Institute of Oceanography and Fisheries, Split, Yugoslavia), Vol. V, No. 1, 45 pp., 4 fig. In German, with Serbo-Croat summary.

Gives an account of coral reefs endemic to Kastela Bay, near Split, with key to the important species and some discussion of their distribution.

FWS 1.015 FISHING — CHINA SEA UDC 639.2(265.6).

Liu Fah-Hsuen, Chen Gin-Chen. REVIEW OF THE GENERAL CONDITIONS OF THE TRAWLING GROUNDS OF THE SOUTH CHINA SEA, I. REGION BETWEEN PENHU (PESCADÓRES) AND HAINAN ISLAND. *Report No. 1*. Research Laboratory, Taiwan Fishery Rehabilitation Administration, Ministry of Economic Affairs, Taiwan (Formosa). 34 pp., 9 pl. In Chinese, with English summary.

A brief summary of information on fishing conditions of the region between the Penhu and Hainan Islands, drawn from reports of three surveys made in 1935, 1936 and 1937 under the Japanese regime. The surveys were carried out by *Chao Nan Maru*, a 417-ton otter trawler. Statistics on the total and the composition of the catches are given. The quantity of the catch and its composition from the different grounds are compared. The area of the grounds is also indicated and oceanography and meteorological conditions are reported.

FWS 1 FISHERIES — GREECE UDC 639.2(495)

Leia [FISHING] Editor, B.D. Castriotis, 90 Mihail Voda Str., Athens, Greece. In Greek, with English summary.

This monthly review of Greek fisheries has contained a summary in English since January 1953, thus making it available to a wider audience.

FWS 1.015 FISHERIES — CEYLON UDC 639.2(548.7)

de Zylva, E.R.A. ADMINISTRATION REPORT OF THE ACTING DIRECTOR OF FISHERIES FOR 1952. Government Publications Bureau, Colombo, Ceylon. 26 pp., tables. In English. Price: 50 Ceylon cents. (Postage: 10 Ceylon cents).

Gives (besides the administrative reports of the various Divisions), fish imports, exports, production, and fishing craft for 1952; an account of co-operative development of fisheries, loans to fishermen, marketing advances, relief to fishermen in distress, insurance facilities, welfare stores, the provision of salt to curers, mechanization of fishing craft and other marine fisheries activities, the prawn oyster, and *Chanos chanos* fisheries, and fisheries by-products in Ceylon.

FWS 1 FISHERIES — UNION OF SOUTH AFRICA UDC 639.2(68.01)

Union of South Africa, Division of Fisheries. TWENTY-SECOND ANNUAL REPORT FOR THE YEAR ENDED DECEMBER 1950. Department of Commerce and Industries, Pretoria, Union of South Africa. 171 pp., tables. In English.

Deals with the survey operations of the *R.S. Africana II*, *R.V. Schipa* and *P.B. Palinurus*, and with the whaling industry, pilchard and maas-

banker, rock lobster, shark and trawl fisheries, and gives a short review of work in connection with fishing harbors. Laboratory activities covering hydrology, biochemistry and other biological work are also reviewed, together with a note on legislative relations and staff. Annex A deals with the pilchard research program and Annex B presents lists containing particulars of stations made by the three craft mentioned above.

FWS 9.1 FISHERIES RESEARCH, UDC 639.2.001.5(46)
 BIOLOGICAL — SPAIN

Spain, Consejo Superior de Investigaciones Cientificas. El Instituto de
 1953 Investigaciones Pesqueras [THE FISHERIES RESEARCH INSTITUTE].
 Barcelona, Spain. 53 pp., illus. In Spanish.

After a very brief note on the value of investigations for fisheries, this pamphlet gives an account of the history of the Institute, of its organization, equipment, activities, exchanges of literature, and publications. The scientific personnel of the Institute are listed.

FWS 9.1 FISHERIES — PERIODICALS UDC 639.2:05(94)
 — AUSTRALIA

Australian Journal of Zoology (Commonwealth Scientific and Industrial
 1953 Research Organization, 314 Albert St., East Melbourne, C.2,
 Victoria, Australia), Vol. 1, No. 1, January 1953. 161 pp., fig.,
 plates. In English. Price: 7s. 6d.

To be issued as material becomes available. The first of this new series contains the following papers: "The Ecology of *Chrysomela gemellata* Rossi and *C. hyperici* Forst., and their Effect on St. John's Wort in the Bright District, Victoria," by L.R. Clark; "An Analysis of the Outbreaks of the Australian Plague Locust, *Chortoicetes terminifera* (Walker), during the Seasons 1940-41 to 1944-45," by L.R. Clark; "Observations on the Biology of *Lyctus brunneus* (Steph.)", by F.J. Gay; and "The Australian Species of *Aponomma* and *Amblyomma* (Ixodoidea)," by F.H.S. Roberts.

The Commonwealth Scientific and Industrial Research Organization, in collaboration with the Australian National Research Council, is also responsible for the publication of the following journals of interest to fisheries workers: *Australian Journal of Biological Sciences* (formerly the *Australian Journal of Scientific Research*, Series B: Biological Sciences), and *Australian Journal of Marine and Freshwater Research* (see *FAO Fisheries Bulletin*, III. (5), p. 117).

FWS 9.15 FISH PARASITES UDC 639.2.09

Sachlan, M. NOTES ON PARASITES OF FRESH-WATER FISHES IN INDONESIA.
 1952 *Contributions of the Inland Fisheries Research Stations*, Djakarta-Bogor, Indonesia, No. 2. 59 pp., 19 photographs, 16 drawings.
 In English, with Indonesian summary.

Summarizes morphological and biological data on parasites of fresh-water fish in Indonesia. Few epidemics have been reported from widely dispersed fish pond areas in Java, but infection of individual fishes with parasites is very common. Reference is made to various kinds of Sporozoa, Ciliata, Nematoda, Trematoda, Cestodes and Acanthocephala. Suggestions are made for treatment of infected fish.

FWS 1.0113 FISHERIES INDUSTRIES UDC 639.211(265.2)
— SALMONS, ETC. — BERING SEA

Barnaby, Joseph T. OFFSHORE FISHING IN BRISTOL BAY AND BERING SEA. *Special Scientific Report: Fisheries* No. 89. United States Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A. 30 pp., tables, illus. In English.

Gives some of the results of investigations conducted in the Bering Sea which were instituted as the result of Japanese fishing for salmon in those waters. The salmon fishery as carried on by United States nationals in these waters is referred to and a statistical series, covering 66 years, is presented. Most of the paper is concerned with experimental off-shore fishing. These operations have indicated that salmon can be taken at any locality on the Continental Shelf in the eastern Bering Sea, also that there are other large populations of bottom fish and shellfish on these grounds. The problem of conservation and protection is discussed.

FWS 9.16 FISH CULTURE — INDONESIA UDC 639.3(91)

Maas, K.F., and Hofstede, A.E. STUDIES ON *Tilapia mossambica* PETERS 1952 (*ikan mudjair*) IN INDONESIA. *Contributions of the Inland Fisheries Research Stations*, Djakarta-Bogor, Indonesia. No. 1. 88 pp., 22 fig., bibl. In English.

Summarizes known data relating to cultivation of *T. mossambica* in Indonesia and of investigations on the bionomics of this species. Feeding and spawning habits and parental care are described, and investigations on the condition factor discussed. Reference is made to the usefulness of *Tilapia* for keeping ponds free of malaria-carrying anopheles, to rearing in rice fields and to culture in combination with carp. The publication is a valuable contribution to knowledge on a species which is rapidly gaining importance as a pond fish in tropical areas throughout the world.

FWS 9.1 FISH TRADE — THE NETHERLANDS UDC 658.6/8(492)

HOLLAND FISH TRADE — A REVIEW OF THE NETHERLANDS FISHING 1953 INDUSTRY (N.V. Drukkerij Trio, Nobelstraat 27, The Hague, The Netherlands), No. 1, May 1953. Monthly.

A monthly publication of which the first issue was released in May 1953 and which deals principally with the export trade of The Netherlands in fisheries commodities.

FWS 2.4 ; 3.23 REFRIGERATION OF FOOD UDC 664.8.037

THE COLD CHAIN IN THE U.S.A. Report of a Group of European Experts. 1951, Technical Assistance Mission No. 17. Organization for European 1952 Co-operation, 2, rue André-Pascal, Paris. Part I, General Report, 74 pp., tables, map, August 1951. Price: F. fr. 300 or 6s. Part II, Technical Survey, 450 pp., tables, illus., December 1952. Price: F.fr. 1,650 or 32s 6d. In English and French editions.

In August-September 1950, an inter-European team of 50 experts from 12 countries visited the U.S.A. "to study the packing, refrigeration, warehousing, shipping, transport, and mechanized handling of perishable foods, together with modernized plant layouts and facilities in such industries." The scope of the study was "to apply the knowledge thus gained in the United States so as to increase efficiency and productivity in similar industries in Europe."

Part I contains in a condensed form the finding and the recommendations of the team. After some introductory chapters a "Comparison between the United States and Western Europe from the Refrigeration Standpoint" is given, followed by a summary, "General Survey of the Aspects of the Cold Chain Studied by the Mission" and a list of recommendations. Also gives a directory of the members of the Mission with information about each one.

Part II is mainly descriptive and has many diagrams and photographs. It contains five main sections. Section I., Basic Considerations, includes Education and Research; Official Instructions, Quality Tests, etc.; Safety Codes; Statistics. Section II., Refrigerating Machinery, covers Refrigerants; Reciprocating and Rotary Compressors; Condensers and Evaporators; Automatic and Auxiliary Devices; Steam Jet Refrigeration; Centrifugal Compressors; Absorption Machines; Commercial and Domestic Refrigerators. Section III., Refrigerating Plants, includes Insulating Materials; Cold Store Construction and Equipment; Operating, Handling and Maintenance of Cold Stores; Locker Plants; Production and Use of Ice; Dry Ice; Air Conditioning; Measuring Instruments. Section IV., Transport, covers Rail Transport; Road Transport; Air Transport. Section V., Refrigeration Applied to Perishable Foods, includes Frozen Foods and Quick Freezing Plants, General; Fruit and Vegetables; The Concentrated and Frozen Juices and Jellies Industry; Meat; Poultry; Processing and Preservation of Eggs; Dairy Products; Fish; Frozen Pre-cooked Foods; The Use of Cold in Other Industries. The book ends with a list of persons interviewed and visits made by the Mission.

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